

I Claim:

19. A method of treating fluids by use of at least one bulk material comprising:

a. flowing a fluid substantially through a plurality of bulk material beds, said fluid flowing from a bottom to a top of at least one bulk material bed;

b. moving said at least one bulk material in at least one of said bulk material beds countercurrent to the flow of said fluid through at least one of said bulk material beds;

c. at least partially adding said at least one bulk material to said top of said at least one bulk material beds so as to provide substantially even distribution of said at least one bulk material over a given bulk material bed until said at least one bulk material in said at least one bulk material bed has been properly exchanged; and,

d. operating a plurality of said bulk material beds in parallel such that said removing and said adding of said at least one bulk material in a plurality of said bulk material beds occurs successively.

20. The method as defined in claim 19, wherein said at least one bulk material bed has been properly exchanged with said at least one bulk material when said at least one bulk material has reach a desired height in said at least one bulk material bed or until a desired amount of said at least bulk material has been removed and replenished in said at least one bulk material bed.

21. The method as defined in claim 20, wherein said at least one bulk material bed has been properly exchanged with said at least one bulk material by at least partially removing said at least one bulk material from said bottom of said at least one bulk material bed while said at least one bulk material is at least partially added to said top of said at least one bulk material bed.

22. The method as defined in claim 20, wherein said at least one bulk material bed has been properly exchanged with said at least one bulk material by at least partially adding said at least

one bulk material to said top of said at least one bulk material bed without removing said at least one bulk material from said bottom of said at least one bulk material bed.

23. The method as defined in claim 19, wherein said at least one bulk material bed includes a loading opening adapted to receive said at least one bulk material into said top of said bulk material bed, and at least one closable unloading opening to controllably remove said at least one bulk material from said bottom of said at least one bulk material bed.

24. The method as defined in claim 19, including a movable bulk material delivery mechanism to at least partially deliver said at least one bulk material to said at least one bulk material bed.

25. The method as defined in claim 24, wherein said bulk material delivery mechanism is moved along a plurality of said bulk material beds.

26. The method as defined in claim 24, including the step of at least partially replenishing said movable bulk material delivery mechanism with said at least one bulk material after said movable bulk material delivery mechanism has at least partially delivered said at least one bulk material to at least one of said bulk material beds.

27. The method as defined in claim 19, including a movable bulk material reception mechanism to receive said at least one bulk material that is removed from said at least one bulk material bed.

28. The method as defined in claim 19, including a movable bulk material delivery mechanism to at least partially deliver said at least one bulk material to said at least one bulk material bed.

29. The method as defined in claim 28, wherein said movable bulk material reception mechanism conveys at least a portion of said at least one bulk material to said movable bulk material delivery mechanism.

30. The method as defined in claim 28, wherein said movable bulk material delivery mechanism and said moveable bulk material reception mechanism are respectively moved over and under the same bulk material bed, and an amount of said at least one bulk material delivered to said bulk material bed is at least partially determined by an amount of said at least one bulk material portion which has been removed from said bulk material bed.

31. The method as defined in claim 28, wherein said flow of said fluid is interrupted or throttled by said movable bulk material delivery mechanism and/or said moveable bulk material reception mechanism.

32. The method as defined in claim 24, including a plurality of sources to supply said at least one bulk material to said movable bulk material delivery mechanism.

33. The method as defined in claim 24, wherein said bulk material delivery mechanism supplies at least two different bulk materials to said at least one bulk material bed.

34. The method as defined in claim 19, wherein said bulk material bed includes a plurality of different types of bulk material.

35. The method as defined in claim 34, wherein at least two different types of bulk material are substantially layered in said bulk material bed.

36. The method as defined in claim 34, wherein at least two different types of bulk material include at least one adsorbent and at least one chemically reactive component.

37. The method as defined in claim 36, wherein said at least one adsorbent includes activated coke, and said at least one chemically reactive component includes calcium hydroxide.

38. The method as defined in claim 24, said movable bulk material delivery mechanism includes a container, said container including a plurality of slit openings or linear openings that are used to at least partially deliver said at least one bulk material in said at least one bulk material bed.

39. The method as defined in claim 38, where said container is movable on guides, and said container includes a trough with closable unloading openings which are arranged over a trough floor in a surface distribution or in a linear arrangement.

40. A fluid treatment apparatus including a plurality of bulk material beds which are arranged next to each other and can be operated in parallel, at least one of said bulk material beds treating a fluid as said fluid substantially flows through said at least one bulk material bed from a bottom to a top of said at least one bulk material bed, said at least one bulk material bed allowing
5 a bulk material to be moved from the top to the bottom of said at least one bulk material bed, said at least one bulk material bed including a bottom opening to controllably remove said bulk material from said at least one bulk material bed and a top opening to add said bulk material into said at least one bulk material bed, at least a plurality of said bulk material beds are interconnected by a shared horizontal charging channel, and at least one bulk material delivery device is movable through a
10 charging channel between a charging position and a plurality of bulk material delivery positions that are positioned above said plurality of bulk material beds.

41. The fluid treatment apparatus as defined in claim 40, including a gas collection space, said gas collection space at least partially formed by said charging channel, an outflow channel running above said charging channel, an outflow channel running laterally with respect to said charging channel, and combinations thereof.

42. The fluid treatment apparatus as defined in claim 40, wherein a plurality of bulk material beds are interconnected by a shared discharge channel, and a bulk material reception container is movable through the discharge channel between said bottom opening and top opening of said bulk material beds.

43. The fluid treatment apparatus as defined in claim 42, including a gas collection space, said gas collection space is at least partially formed by said discharge channel, a feed channel which runs under the discharge channel, a feed channel which laterally to the discharge channel, and combinations thereof.

44. The fluid treatment apparatus as defined in claim 40, including a bulk material delivery container and/or a bulk material reception container, said container including a throttling device to close off or throttle fluid entry to the bottom of said bulk material bed, fluid exiting the top of said bulk material bed, and combinations thereof.

45. The fluid treatment apparatus as defined in claim 44, wherein said bulk material delivery container and/or said bulk material reception container includes a series of funnel elements.

46. The fluid treatment apparatus as defined in claim 45, wherein said funnel elements are positioned on said bulk material reception container, said funnel elements each including lateral walls to provide for the inward flow of fluid, said funnel elements each including a roof-shaped distribution element positioned over a circumference of said funnel and projecting from an internal side of the funnel, said roof-shaped distribution element open at a bottom to impinge fluid flow.

47. The fluid treatment apparatus as defined in claim 40, wherein said bottom opening of said bulk material bed includes a flow path floor that allows removal of said bulk material from said bulk material bed and delivery of said fluid into said bulk material bed.

48. A method for treating fluids by a first bulk material comprising:

- a. introducing said first bulk material in a fluid stream;
- b. entraining said first bulk material on a filter as said fluid flows through the filter;
- c. removing a filter cake formed by said first bulk material on said filter;

5 d. at least partially treating said fluid with said first bulk material in a moving bed reactor, said moving bed reactor including a bulk material bed at least partially formed of a second bulk material, said fluid substantially flowing from a bottom to a top of said bulk material bed and said second bulk material substantially moving from the top to the bottom of said bulk material bed,

- e. adding said second one bulk material to said top of said bulk material bed and

10 removing said second bulk material from said bottom of said bulk material bed; and,

- f. at least partially separating said first bulk material from said fluid in said bulk material bed.

49. The method as defined in claim 48, wherein fluid is post reacted with said first bulk material and further treated by said second bulk material as said fluid flow through said moving bed reactor.

50. The method as defined in claim 48, wherein said first and said second bulk materials are removed together at said bottom of said bulk material bed.